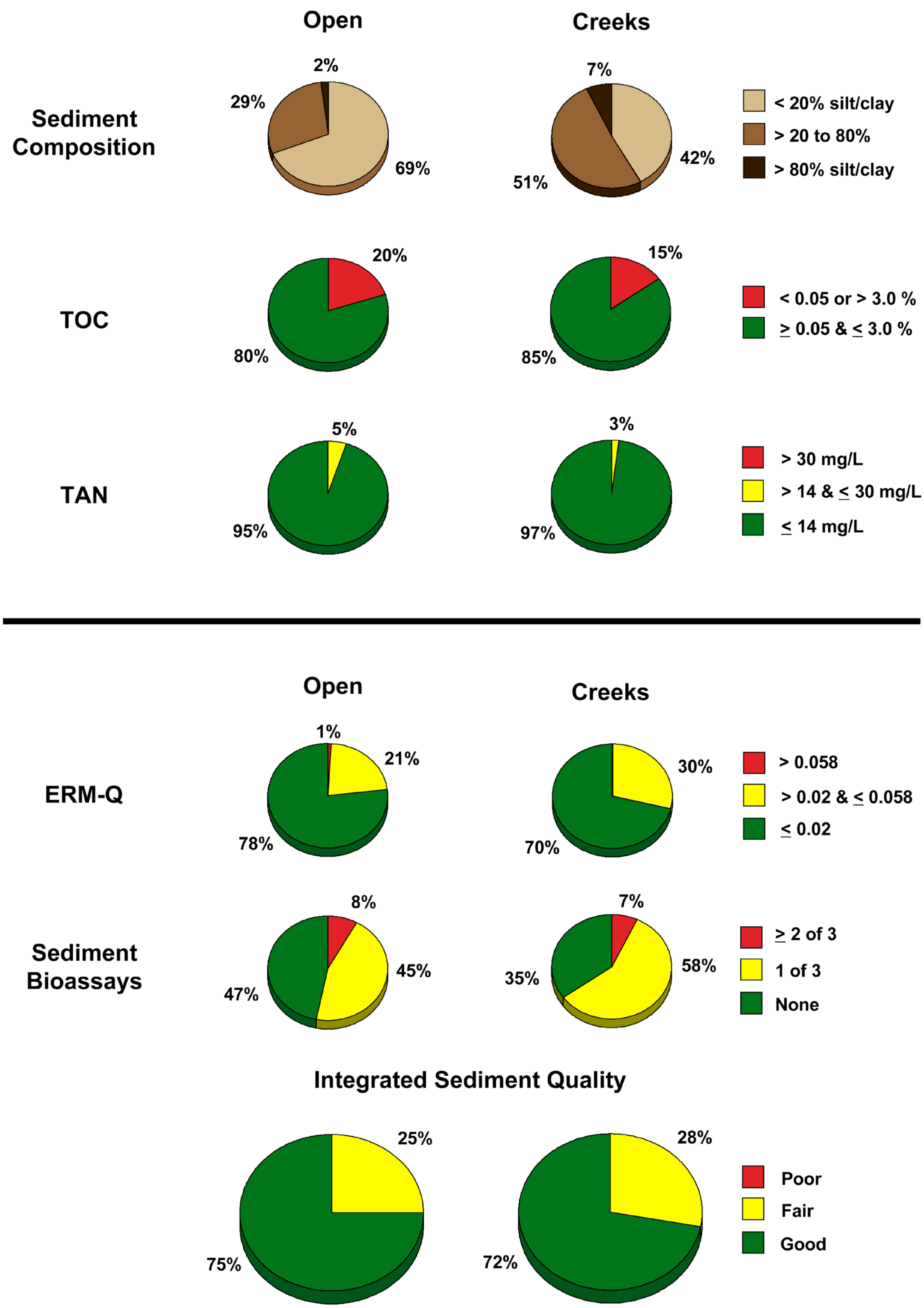

Figure 3.3.1. Comparison of the percent of the state's coastal habitat represented by various sediment quality conditions and integrated sediment quality scores.

scores), but it also did not generate a large number of false positive results (detected toxic conditions at 9% of stations with good ERM-Q scores; Table 3.3.3). Combining the Microtox® and clam bioassay to generate a score of 0 (positive in neither assay), 1 (positive in one assay), or 2 (positive in both assays) tends to decrease rates of false positive and false negative results. 53% of stations with good ERM-Q scored 0 in the combined assays, and 96% scored a 0 or 1. 43% of stations with poor ERM-Q scored as 2 in the combined assay and 100% scored as 1 or 2. Taken together, this supports coupling these bioassays in studies of sediment toxicity such that the Microtox® assay provides the ability to more consistently detect sites that have high sediment contaminant loads while the clam assay helps to limit the number of stations incorrectly identified as toxic by the Microtox® assay.

The "false positive" rate in the toxicity bioassays may reflect the effects of contaminants not incorporated into the ERM-Q or other environmental parameters. Most of the contaminants measured by SCECAP as well as many new unmeasured contaminants in the environment have no published bioeffects guidelines. For example, station RT042266 had unusually high concentrations of two PAH compounds considered to be carcinogenic, but these contaminants could not be incorporated into the ERM-Q due to lack of bioeffect guidelines. Environmental parameters other than sediment contaminants could also contribute to station toxicity. For example, while station RO046076 possessed an ERM-Q score indicative of fair conditions, both the Microtox® and clam bioassays indicated it was toxic; this station also possessed the lowest dissolved oxygen concentration of the current study period and the highest TAN value recorded in the six years of the SCECAP study.

Integrated Assessment of Sediment Quality

The integrated sediment quality index combines ERM-Q (a measure of total sediment contaminant levels) and sediment toxicity bioassays (a measure of the bioeffects of sediment contaminants). For SCECAP, an integrated sediment quality score of < 2 represents relatively poor sediment quality, scores ≥ 2 but < 4 represent fair sediment quality and scores ≥ 4 represent good sediment quality. During the 2003-2004 study period, 25% of open water and 28% of tidal creek habitat scored as fair while no habitat scored as poor (Figure 3.3.1). This suggests an improvement over the previous two study periods with the percent of habitat scored as good increasing from 72% to 75% in open water habitats and from 60% to 72% in tidal creek habitats (Figure 3.3.3). The large difference in the tidal creek habitats between study periods is due to an relatively small percentage (44%) of tidal creek stations receiving a good integrated sediment quality score in 2001. This same year had the highest proportion of false positive bioassay results (69%) in tidal creek habitats of any year. However, on a yearly basis, there has been no significant change in the integrated sediment quality scores of open water or tidal creek stations since the beginning of SCECAP monitoring (Fig 3.3.3).

The conflicting trends noted between the integrated sediment quality scores (which suggest improving or unchanging habitat quality) and ERM-Q (which suggest increasing contamination) likely reflect the averaging of ERM-Q and toxicity bioassay results in conjunction with a high rate of false positive and negative results among the bioassays. For example, the station with the highest ERM-Q during the current report period only scored as toxic in the Microtox® bioassay. Conversely, of the stations that scored as toxic in both the Microtox® and clam bioassays, 42% possessed low-risk ERM-Q values and only 13% possessed high-risk ERM-Q values. The result is that, once combined into an integrated score, these components average out to produce good or fair conditions at most stations. This stresses the importance of considering the individual components of the integrated scores (whether water quality, sediment quality or biological integrity) rather than relying solely upon the integrated scores for judging the state of our coastal waters.

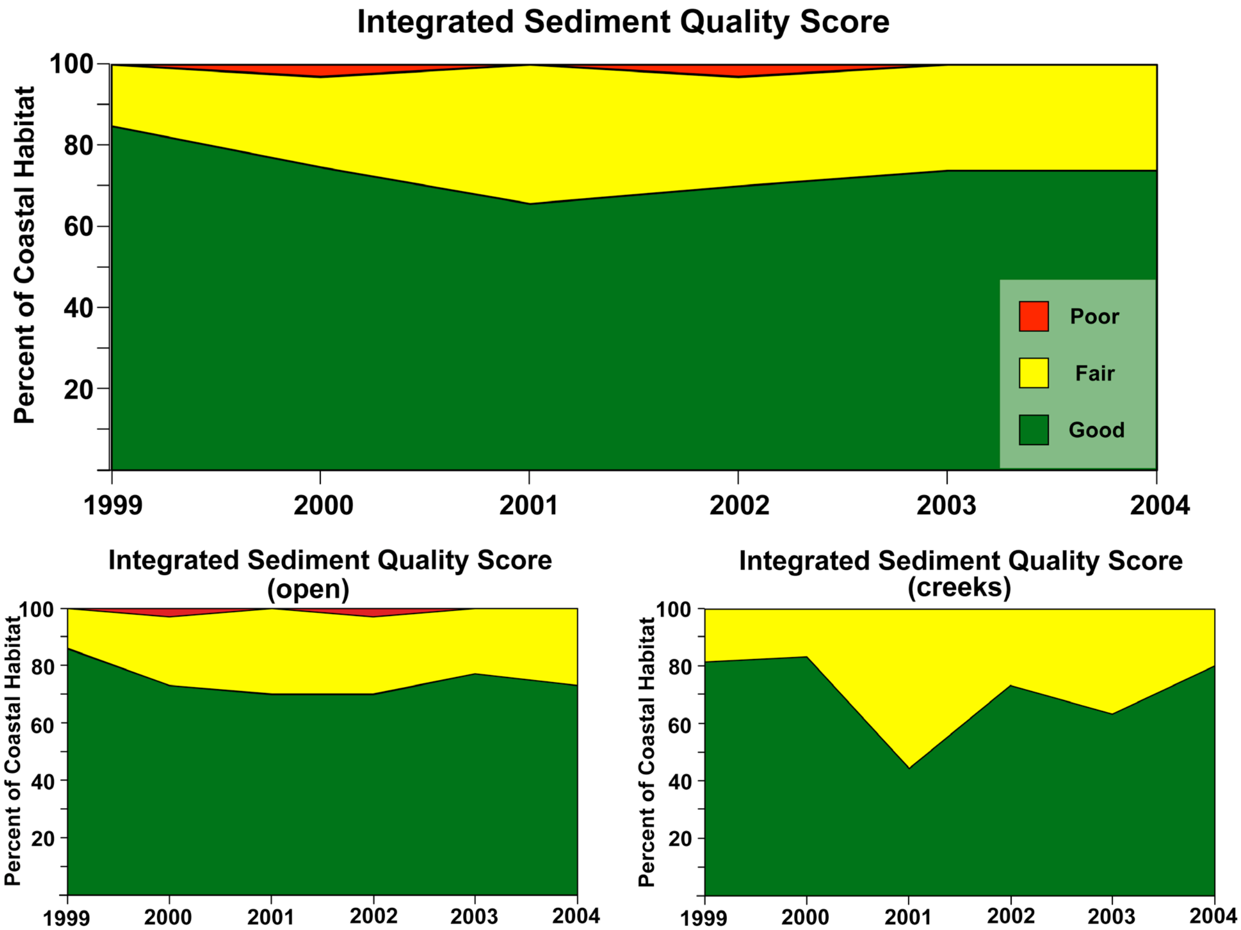

Figure 3.3.3. Proportion of the South Carolina's estuarine habitat that ranks as good (green), fair (yellow) or poor (red) using the integrated sediment quality score when tidal creek and open water habitats are combined and compared on an annual basis, and for tidal creek and open water habitats considered separately.

3.4 Biological Condition

Phytoplankton

Phytoplankton biomass and composition serve as valuable indicators of estuarine health because these primary producers respond rapidly to increases in nutrient loading. Even short-term increases in nutrient inputs can promote blooms of algal species that are often present but not overabundant in balanced, healthy estuarine systems. Increased nutrient inputs promote a complex set of environmental responses, beginning with shifts in algal composition and leading to blooms of harmful species that have deleterious impacts on biota (Bricker *et al.,* 1999). Harmful species are defined by the potential to produce blooms or toxins that have negative effects on biological systems (causing fish kills for example) and in some cases cause human health problems (such as paralytic shellfish poisoning).

Most harmful algal species fall within the cyanobacteria, dinoflagellate and raphidophyte groups, although not all species within these taxa are harmful and some may appear within the diverse assemblages of pristine estuarine systems. These

Fishkill in a stormwater detention pond caused by a toxic cyanobacterial bloom. Photo credit: SCAEL